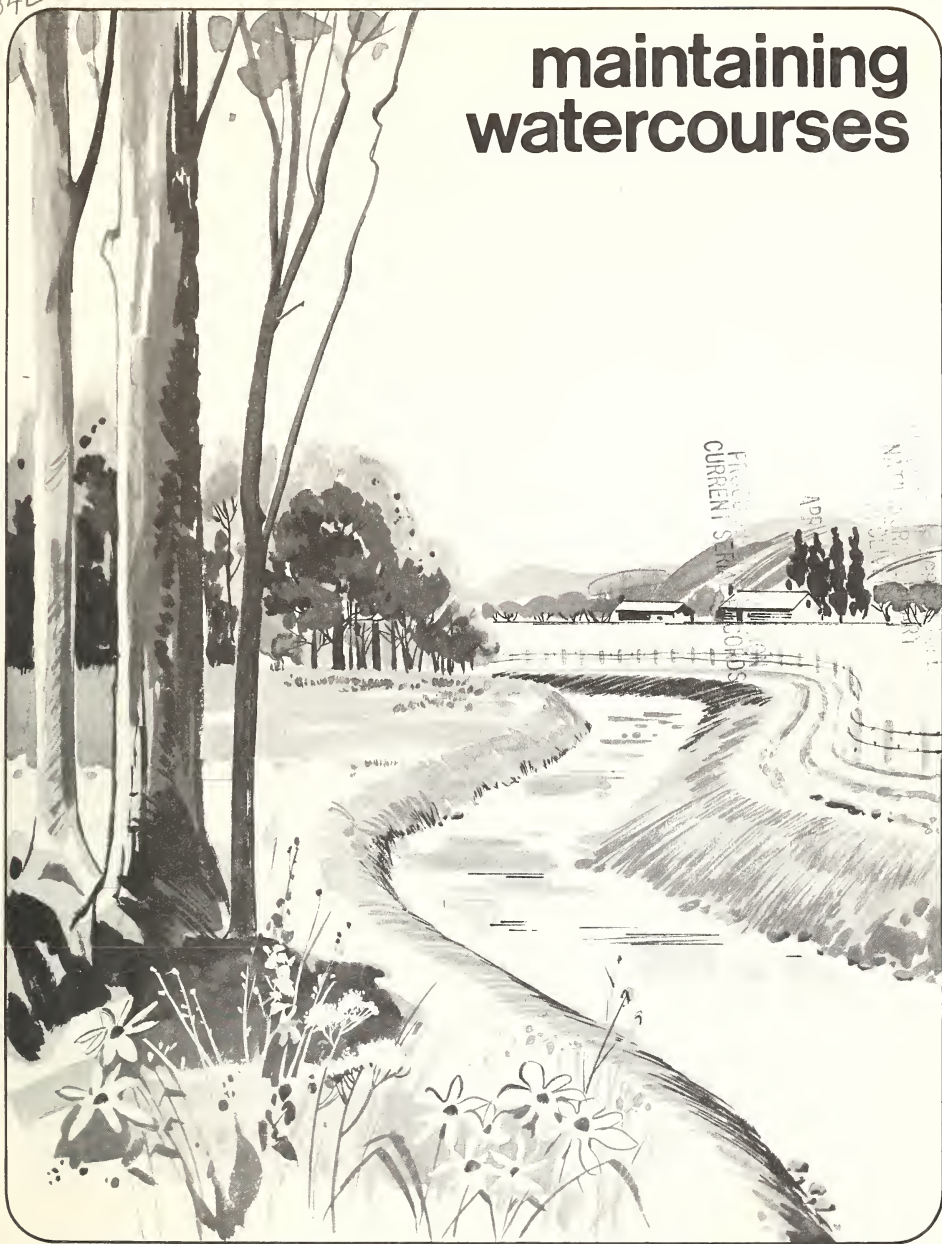


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maintaining watercourses



MAINTAINING WATERCOURSES

Soil Conservation Service, U.S. Department of Agriculture

If a watercourse is not maintained, its flow capacity usually decreases. Watercourse maintenance is too important to be left to chance. Preferably an organization should be formed by the landowners concerned to plan, schedule, and finance regular maintenance.

This leaflet describes the general characteristics and maintenance requirements of watercourses and watercourse structures. It should help landowners understand the kind of maintenance their watercourse requires and how to organize for it.

Maintenance organization

Watercourse maintenance usually concerns several landowners and may require participation of local, county, and state authorities. For this reason some form of organization is necessary to conduct maintenance operations successfully.

A maintenance organization can be established by an informal agreement between two or more landowners for a small watercourse or by a legally organized district for a larger watercourse.

It is best if parties to the organization assign responsibility for maintenance to one individual. This

may be a full-time or part-time job depending on the scope of the work. Too often when responsibility for maintenance is divided between several people, the work is not done properly or on schedule.

The most effective maintenance programs are conducted by organizations that can hire their own work force and buy their own equipment. Two or more maintenance groups or districts may pool their resources if the workload of each is not large enough to justify purchasing needed equipment or hiring a contractor.

The cost of maintenance depends on the type of work to be done and the availability of labor, materials, and equipment. Generally the more work required, the easier it is to obtain experienced personnel and suitable equipment at a reasonable rate. In areas where much work is required, private companies have been organized to provide maintenance on contract.

A maintenance plan provides a basis for regular inspection and maintenance. A plan generally includes maps of the watercourse; shows the position of structures, fences, drains, vegetation, and other features; itemizes maintenance requirements for all parts of the



Close-growing vegetation prevents erosion on side slopes. Periodic mowing of the bottom and side slopes is required to insure adequate flow. The well-maintained travelway provides access to the watercourse. C-5467-1

watercourse; and lists the kinds of wildlife and fish, grasses, trees, and shrubs throughout the watercourse. Such an inventory helps keep sponsors, contractors, and inspectors informed of all important characteristics of the watercourse. A sample maintenance plan is shown on page 4.

A maintenance fund can be established to pay for both scheduled and emergency work. Mowing and other routine maintenance generally can be scheduled and costs estimated closely from year to year, but the need for sediment removal or repair of concrete or rock riprap may vary considerably from year to year. Maintenance organizations with enough work to justify obtaining their own equipment and work force can readily arrange for timely removal of sediment. Organizations with less work often delay removal until enough sediment accumulates to make the job attractive to private maintenance contractors.

Frequent and thorough inspections are necessary. Inspectors should know the condition that must be maintained to keep the watercourse performing as planned and should prepare a written report of maintenance required. Inspection reports can be used for scheduling maintenance work. Records of maintenance costs should be kept. They are especially helpful in preparing budgets or assessments for maintenance work.

Individuals who arrange for maintenance work and those who perform the work must be safety conscious. Equipment such as tractors should have protective frames or crush-resistant safety cabs. Mowers and moving parts such as power takeoff units should have protective shields. Workers should wear hardhats when operating maintenance equipment and protective clothing when handling chemicals or other materials that may be harmful on contact.

Characteristics of lined and unlined watercourses

The bottom and sides of a watercourse may be unlined, except for vegetation, or lined with concrete or other erosion-resistant material.

Flow capacity under any given flow conditions depends on the roughness of the watercourse at and below the water surface. In designing unlined watercourses, the flow capacity required is based on the expected roughness after the watercourse has aged. Removing excess vegetation, sediment, and debris that obstruct flow is a major concern in maintaining both lined and unlined watercourses.

Unlined watercourses that carry flow intermittently



Debris may accumulate at culverts, bridges, and other structures following peak flows.

MO-L-315-2

and dry up at times during the year generally have close-growing vegetation on the bottom and side slopes. Growth of such vegetation must be maintained to prevent erosion, but mowing is often required to insure adequate flow in periods of runoff and to prevent excessive siltation.

Unlined watercourses that carry shallow flow all year long may have weirs to raise the water level. This prevents growth of vegetation on the bottom and on parts of slopes below the water surface. Parts of slopes above the water surface are seeded with or maintained in close-growing vegetation.

Lined watercourses, usually of reinforced concrete or riprap, are installed in areas where stability or high flow capacity cannot be achieved with an unlined watercourse. The bottom and side slopes are lined with rock riprap, concrete, or other material. Because lined watercourses usually have a smoother surface and lack vegetation, flow retardance is much less than in unlined watercourses. An exception is large rock riprap used to line a watercourse in order to increase roughness and flow retardance.

A watercourse can be designed to accommodate equipment necessary for maintenance. Ramps can provide access to the bottom of a large watercourse. A tractor equipped with a front-end loader can then be used to remove accumulated silt and debris when the bottom of the watercourse is firm enough to support

the equipment. Travelways can be constructed on one or both banks to accommodate mowing equipment. Access roads to the watercourse should be provided for maintenance equipment. On unmodified watercourses, special methods may be required to move equipment along or in the watercourse.

Swinging watergates are installed to prevent clogging where fences cross watercourses. Gates can be installed where fences cross travelways to permit continuous travel of maintenance equipment.

Side inlet structures for field drains and for natural drainage into a watercourse help control erosion and reduce sedimentation. Such structures can also provide a place for maintenance travelways to cross minor tributaries.

Establishing vegetation

Vegetation is planted along a watercourse for erosion control, fish and wildlife habitat, and beautification. A detailed plan for establishing vegetation can be based on adapted species, watercourse flow characteristics, and possible multiple use of the area adjacent to the watercourse. Local vegetation guides indicate the species of plants, shrubs, and trees adapted to the area. Different plants may be required for the bottom, lower and upper parts of side slopes, and berm and spoil areas.

If grass and forb cover is desired, mowing or spraying with approved chemicals may be necessary to control woody growth. If woody cover is desired, seeding a suitable cover crop first, such as small grain or grass, helps control erosion; then trees and shrubs can be planted or native woody plants allowed to invade the site. For beautification, adapted ornamentals can be planted where a watercourse crosses or is adjacent to roads, urban areas, and parks.

Vegetation can be established on cut slopes using conventional farm machinery, stolon and rhizome planters, hydraulic seeders, and other kinds of equipment. Availability of travelways and steepness of slopes determine which kind of machine is most suitable.

Seeding failure may be caused by poor weather, droughtiness, erosion, and other adverse site conditions. Maintaining a dense plant cover is difficult on slopes steeper than 2 feet horizontal to 1 foot vertical. On steep slopes it may be necessary to plant by hand or use sod, riprap, or other material for adequate protection. Irrigation may be needed to establish vegetation in areas of low rainfall.

Establishing vegetation is difficult where soils have low fertility or are acid. The acidity of the soil should



A rotary mower can be used to clear vegetation if a travelway is provided. NC-2,079

be determined before planting. On infertile soils, fertilizer must be applied each year for several years after seeding to insure growth of vegetation.

Mulching with weedfree hay and straw provides temporary protection of eroded areas and helps reestablish vegetation. Mulching is mainly suited to berms and spoil areas and to the upper part of slopes that are not subject to flow. In some areas, asphalt binding or commercial netting has been used successfully to hold mulch in place on slopes that are subject to flow.

Once introduced plants have been established, native plants usually invade the site. Growth of native plants is desirable because they strengthen the cover.

Controlling vegetation

Loss of flow capacity occurs when logs, trees, debris, sediment, and overgrown or woody vegetation clog a watercourse. For example, willow trees growing on side slopes can reduce flow in a small watercourse by as much as 60 percent. In humid coastal areas, a watercourse may be clogged with vegetation and sediment within 7 to 10 years if not properly cleared.

Flow conditions and the type of watercourse determine the time of year that clearing and mowing can be done. The time of year that maintenance is performed can significantly affect wildlife and ecosystems. Wildlife and natural values should be considered in scheduling work and selecting methods to be used.

Mowing and cutting should be done where needed when they are least likely to harm fish and wildlife



A swinging watergate prevents debris from accumulating and keeps livestock from crossing fenced areas. IN-L-690-7

and when the banks are least subject to overflow. Mowing after the nesting season is a good practice. Selective mowing and mowing alternate sides of the watercourse in different years reduces adverse effects on fish and wildlife.

Trees and shrubs require extra effort to maintain and control. Generally more handwork and use of power saws and power winches is required to remove fallen trees and tree limbs from the flow area. A most effective method is to cut back woody plants in July or early in August following the lush spring growth. Residue should be disposed of so that it does not clog the watercourse or watercourse structures.

A rotary mower suspended on a long, flexible arm and mounted on a crawler tractor is commonly used for mowing side slopes. A wheel tractor or motor grader equipped with this type of mower is not so versatile as the crawler but can also be used. If the watercourse is wide enough, the bottom is dry and compact, and adequate access roads are available, a highway mower moving along the bottom of the watercourse can be used for mowing side slopes. Vegetated access roads can be mowed with a multiple-unit rotary mower.

Chemicals, such as algacides and herbicides, are used for controlling undesirable algae and vegetation in watercourses. All chemicals must be registered for specific uses by appropriate state and federal agencies. Their use and disposal are strictly regulated. Information on permissible chemicals can be obtained from local representatives of agricultural agencies and

chemical dealers. Chemicals can injure humans, domestic animals, beneficial insects, desirable plants, and fish and wildlife if not handled or applied properly.

Grazing livestock to control vegetation in watercourses generally is not effective. The combination of soil properties, flow conditions, and periods of grazing must be such that the livestock do not damage the berms, side slopes, and bottom of the watercourse. Fencing to exclude livestock generally is recommended to protect vegetation and reduce pollution from animal waste and sediment.

Burning to control vegetation may be dangerous and generally is not recommended. Burning, when used, must be timed not to harm desirable vegetation or wildlife. Damage to bridges, side inlets, watercourse structures, watergates, and fences is a hazard. Burning permits commonly are required by local or state pollution control agencies.

Removing sediment

Sediment generally accumulates on the inside of curves and in flatter parts of unlined watercourses. If sediment is not removed or redistributed, flow capacity is reduced and native shrubs may become established on the accumulated sediment.

Equipment used to remove sediment includes draglines, backhoes, gradealls, bulldozers, and front-end loaders. A dragline is generally best for large watercourses. It can be equipped with a bucket designed for sediment removal or a bucket specially designed for clearing or snagging operations. A dragline removes sediment with a minimum of disturbance to other parts of the watercourse.

Backhoes are suited to small watercourses less than 20 feet wide. Bulldozers and front-end loaders can be used if the bottom of the watercourse is firm, dry, and wide enough to permit operation. Bulldozers can redistribute small amounts of sediment along the toes of side slopes. Front-end loaders are especially useful for removing sediment from the bottom without disturbing the side slopes.

Maintaining watercourse linings

Generally the flow velocity in a lined watercourse is such that debris and large amounts of sediment do not accumulate. In urban areas, when there is a long period between flows, it may be desirable to remove small amounts of debris and sediment to improve the appearance of the watercourse.

Watercourses lined with concrete require cleaning

and filling of contraction joints, cleaning and repairing of weep holes and screens, and repairing or replacing of concrete sections that may have deteriorated or cracked. Similar maintenance is needed for pneumatically applied mortar linings.

Dislodged rock riprap material must be replaced promptly to prevent further damage. It is a good practice to stockpile riprap at convenient locations so that it is readily available. In urban areas grouting may be necessary to reduce damage from vandalism.

Gabion structures (heavy wire baskets filled with rock) are used where rock of size and quality suitable for riprap is not readily available. Baskets must be checked for broken or deteriorated wires and repaired to keep rock in place. Timber crib (treated lumber or logs or untreated timber of adequate quality) dislodged by stream flows should be repaired or replaced. Sacked concrete and cellular block linings dislodged or removed by stream flows or by unequal settlement should be repaired or replaced.

Travelways and access roads

Travelways and access roads facilitate inspection and maintenance of watercourses. Frequent maintenance may be needed to keep them open at all times.

Some watercourses may be large enough to justify paving or gravelling travelways and access roads. Gates and fences may be needed in some areas to protect travelways. Otherwise landowners may crop the area set aside for them or unauthorized drivers may use them when the ground is soft. Gates or barriers at road crossings help prevent unauthorized use.

Bridges and culverts

Debris may pile up at bridges and culverts, especially following major storms, and reduce the flow of a watercourse. Managers of the watercourse can arrange prompt removal of debris with the owners of the bridge or culvert.

Erosion is a hazard at or near bridges and culverts because flow is often restricted. Rock riprap and concrete paving are commonly used to prevent erosion. Riprap and paving should be inspected regularly to be sure they are not dislodged or damaged. Eroded areas should be promptly repaired and reseeded or protected by riprap or paving.

Surface inlets, drain outlets, and sediment basins

Water from areas adjacent to a watercourse may cause damage as it flows across the berm and side



Rock riprap protects side slopes from erosion and blends gracefully into the landscape. NJ-40,573

slopes. Surface inlets can alleviate this problem. Inlets can also be used to control flows from small tributaries.

Deteriorated or damaged parts of inlets must be repaired or replaced and crop residue and trash regularly removed from trash guards. Inlet location markers used to insure safety of livestock, equipment, and personnel should be maintained. Sediment that passes through inlets and accumulates in the watercourse must be removed periodically.

Subsurface drain outlets into watercourses must be repaired and replaced from time to time. In cold climates ice damage is a hazard. Outlets can be recessed to reduce damage from floating debris and ice, and side slopes adjacent to large outlets can be paved to prevent erosion.

Sediment and debris basins in or near a watercourse must be cleaned and repaired periodically.

Stabilization structures, dikes, and floodways

Structures built to reduce the gradient of a watercourse are commonly made of concrete, metal, timber, rock, and other materials. Because flow velocity is high in and around these structures, erosion may occur. Riprap and linings can be used on side slopes adjacent to these structures to prevent erosion.

In order for the watercourse to carry the required flow it may be necessary to construct dikes or floodways. Because dikes are usually constructed of earthfill over poor foundation soils, repair of unequal settlement areas and seeps may be required.

Vegetation on floodways must be maintained. The entrance and exit sections usually require special maintenance. Restrictions on use of floodways must be enforced so that landowners do not encroach on the flow area and damage the cover vegetation. Fences

and barriers may be needed to control vehicular travel.

Structures for water control and fish and wildlife management

Structures can be built in a watercourse to control drainage and irrigation water or to facilitate management for fish, wildlife, and recreation. Control structures usually require adjustment several times a year, repair or replacement of deteriorated and damaged parts, removal of trash and debris, and possibly painting. Stoplogs used to regulate flows must be replaced periodically. Structures with automatic controls or with motors or engines require additional maintenance.

Structures used for fish and wildlife management include deflectors, pool diggers, fish ladders, and other special equipment. Replacement or repair of damaged sections and removal of trash are common maintenance requirements. Maintaining the level and flow of water is often a critical concern, and frequent inspections may be needed to be sure that structures are performing as planned.

In urban areas, especially where floodways may be used for many purposes, removal of paper, bottles, and other trash and repair of eroded sections are generally continual maintenance requirements. Placement and upkeep of trash receptacles may be necessary.

Fences and watergates

Fences used to restrict access of livestock to the watercourse should be carefully maintained. Watergates are used to reduce restriction of flow where a rigid fence crosses a watercourse. Crop residue and debris that collect on fences and watergates during high flows must be removed, and posts, wire, and other material that may have been damaged by flows, livestock, or vandalism should be repaired or replaced.

Issued November 1975

